A Trade Study and Metric for Penetration and Sampling Devices for Possible Use on the NASA 2003 and 2005 Mars Sample Return Missions

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Abstract

The scientific exploration of Mars will require the collection and return of subterranean samples to Earth for examination. This necessitates the use of some type of device or devices that possesses the ability to effectively penetrate the Martian surface, collect suitable samples and return them to the surface in a manner consistent with imposed scientific constraints. The first opportunity for such a device will occur on the 2003 and 2005 Mars Sample Return missions, being performed by NASA. This paper reviews the work completed on the compilation of a database containing viable penetrating and sampling devices, the performance of a system level trade study comparing selected devices to a set of prescribed parameters and the employment of a metric for the evaluation and ranking of the traded penetration and sampling devices, with respect to possible usage on the 03 and 05 sample return missions. The trade study performed is based on a select set of scientific, engineering, programmatic and socio-political criterion. The use of a metric for the various penetration and sampling devices will act to expedite current and future device selection.